Prevalence and Risk Factors for Diabetes and Diabetes-Related Amputations in American Indians in Southern Arizona

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OBJECTIVE— To describe the prevalence of NIDDM and LEA using data from a computer-based patient data base.

RESEARCH DESIGN AND METHODS— Diabetic patients with and without LEA, and nondiabetic patients were identified by computer search. Charts of diabetic patients were reviewed for confirmation of diagnosis of diabetes and diabetes-related amputation. The diabetic and nondiabetic populations were described, and certain risk factors were identified.

RESULTS— The overall prevalence of NIDDM in this tribe in 1985–1986 was 18.3/100 adults (≥18 yr of age), whereas the prevalence of LEA/100 adults with NIDDM was 10.3%. Females were 1.3 times as likely to have diagnosed diabetes as males (95% CI 1.2–1.4), and males with diabetes were 1.4 times more likely to have had LEA than females with diabetes (95% CI 1.1–1.9).

CONCLUSIONS— Automated health-care delivery data base used for this tribe can be used to maintain surveillance for diabetes and amputations in diabetic patients. Effective programs to prevent complications of diabetes, such as LEA, in this tribe are urgently needed.

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THE OPINIONS EXPRESSED IN THIS ARTICLE ARE THOSE OF THE AUTHORS AND DO NOT NECESSARILY REFLECT THE VIEWS OF THE INDIAN HEALTH SERVICE.

NIDDM, NON-INSULIN-DEPENDENT DIABETES MELLITUS; LEA, LOWER-EXTREMITY AMPUTATION; CI, CONFIDENCE INTERVAL; IHS, INDIAN HEALTH SERVICE; ICD, INTERNATIONAL CLASSIFICATION OF DISEASES.

Diabetes and its complications are major and growing disease problems for American Indians (1). The Pima Indians of southern Arizona now have the highest known prevalence of NIDDM in the world: >50% of Pima Indian adults >35 yr of age have NIDDM (2). Advanced stages of peripheral diabetic neuropathy and lower limb amputation are two diabetic complications that may be avoidable with sound intervention programs targeting high-risk populations (3). We have used the IHS data base management system to identify and describe Indians with NIDDM in one IHS service area in southern Arizona. We compared the information in this surveillance system with that in a physician-maintained diabetes registry. In addition, we compared diabetic patients with lower limb amputations with diabetic patients without amputations and with other nondiabetic individuals to identify risk factors associated with diabetes-related amputation.

The IHS provides health-care services to American Indian patients directly through IHS hospitals and clinics and pays for additional services provided in non-IHS facilities. Clinical and demographic data about American Indian beneficiaries are collected for each inpatient and outpatient encounter in an automated data base management system. The IHS patient care data system is based on the Veteran's Administration Filemanager (Fileman) (4). Although the primary objective of this system is to support individual patient care, it can also be used to maintain surveillance for selected diseases and events.

The IHS Tucson service area is located in southern Arizona; it consists of one hospital and three clinics. An estimated 18,000 American Indians in this area are eligible for IHS services. Approximately 80% of these American Indians are members of the Tohono O'odham tribe, thought to be closely related to the Pima Indians. The clinical diagnoses, vital signs, laboratory values, prescrip-

tions, clinical disposition, and other information are entered for every patient encounter in IHS facilities in this area. In addition, information is collected and entered for health-care encounters that occur outside IHS facilities when the IHS is fiscally responsible for the care. This encounter information is linked to the automated data base for each patient that includes a problem list, a medication list, the history of surgical procedures, and previous inpatient and outpatient encounters.

RESEARCH DESIGN AND METHODS— For this study, we sought all Tohono O'odham Indians, ≥18 yr of age, who had at least one visit to an IHS clinic or non-IHS facility during 1985–1986. Patients with at least one encounter resulting in a diagnosis of diabetes (ICD code 250.00–250.81), and a diagnosis or procedure code suggesting a lower limb amputation (ICD code 250.80–250.81, ICD procedure 84.10–84.90) were identified. Diabetic patients without amputations and nondiabetic patients were also identified. IHS providers use the National Diabetes Data Group criteria for diagnosis (5). Chart reviews for the patients with diabetes identified showed that all these patients were either on medication for diabetes or had plasma glucose values >200 mg/dl on the chart. Chart reviews for all patients with LEA confirmed that all amputations occurred as a result of diabetes. For this investigation, age, sex, community of residence, and number of 1985–1986 encounters were sought.

RESULTS— Of 8363 adult American Indian clinic users identified, 18.3% (1535 of 8368) had diabetes. The average age of the patients with diabetes was greater (51.6 yr) than that of the patients without diabetes (36.6 yr). The prevalence of diabetes in the adult clinic user population ranged from 2.7% in 18- to 29-yr-olds (82 of 3003) to 42.6% in 60- to 69-yr-olds (255 of 597); the prevalence in subjects ≥50 yr of age was 3.6

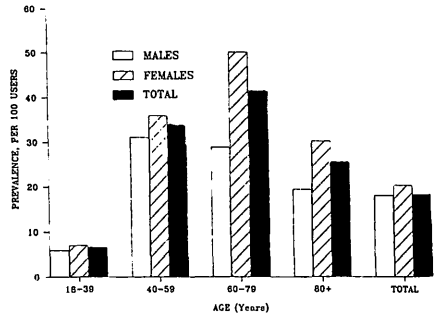

Figure 1—*Prevalence of diabetes in an American Indian tribe in southern Arizona, 1985–1986, by sex and age-group.*

(95% CI 3.3–4.0) times the prevalence in those <50 yr of age (40.3%, 837 of 2068, compared with 11.1%, (698 of 6292). As expected, the prevalence of diabetes increased with age for both male and female clinic users (Fig. 1). Female clinic users were 1.3 times more likely than male clinic users to have diagnosed diabetes (95% CI 1.2–1.4). There was no increased risk of a diagnosis of diabetes or of amputation for people living in communities with a health facility compared with diabetic individuals living in a community without a health facility.

In 1985–1986, 10.3% (158 of 1535) of the identified diabetic individuals had a history of lower limb amputation caused by diabetes (Fig. 2). Like the diagnosis of diabetes, the risk of amputation increased with age. Diabetic patients >49 yr of age were two times more likely than younger patients to have had an LEA (47 of 698 of those ≤49 yr compared with 111 of 837 of those >49 yr of age) (95% CI 1.4–2.7). Males with diabetes were 1.4 times (95% CI 1.1–1.9) more likely to have had an amputation than females with diabetes.

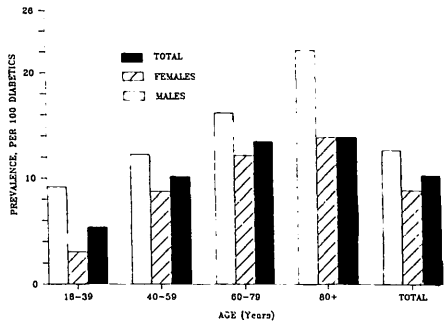

Figure 2—*Prevalence of LEAs in diabetic patients in an American Indian tribe in southern Arizona, 1985–1986, by sex and age-group.*

The frequency of clinic use varied greatly among the diagnostic groups studied. Although diabetic patients with amputations comprised only 1.9% of American Indian adults who sought care in the Tucson IHS area in 1985–1986, they accounted for 8% (10,286 of 122,972) of the total visits, an average of 65 visits/patients for this 2-yr period. By comparison, patients without diabetes averaged 10.8 visits/patient, and patients with diabetes but without amputation averaged 28.2 visits/patient.

CONCLUSIONS— Using only 2 yr of inpatient and outpatient encounter data from a passive, computer-based surveillance system, we were able to describe the prevalence of diabetes and lower limb amputations in people with diabetes in our population, create a diabetes registry, and begin to identify risk factors for diabetes and amputation. Our study found higher prevalence rates of diabetes for females than males. This finding was previously noted in the Pima Indians (6), and more recently in American Indians of the Pacific Northwest (7). The finding is in apparent contrast to that in the U.S. population, where there is little clear evidence that sex is a risk factor for NIDDM (8). Our study found higher rates of LEAs for men with diabetes compared with women with diabetes. The risk of amputations has previously been found to be greater for men than for women with diabetes both in the U.S. and in the Pima Indians (9,10).

There are several potential shortcomings of our automated surveillance system. The sensitivity and specificity of information on this system are ultimately determined by the clarity, legibility, and

diagnostic accuracy of provider input. Second, like all information generated from health-care utilization data, a selection bias probably exists. To the extent that women, the elderly, or individuals with diabetes seek care more often than do other groups, the magnitude of risk factors identified by comparing these frequent users to less frequent users may be overestimated. Tucson IHS area estimates that 90–95% of the eligible American Indian population in this area is seen in Tucson IHS area health facilities during any 2-yr interval (Rummelt, unpublished observations). Unfortunately, it is not known at this time which groups may be disproportionately represented in the 5–10% of people who do not frequently use health-care services, because the age and sex distribution of the eligible nonusers has not been determined.

Despite these shortcomings we conclude that the automated health-care delivery data base used for this tribe can be used to maintain surveillance for diabetes and amputations in diabetic patients. Because the prevalence of diabetes is very high in this tribe, effective programs to prevent complications such as LEA are urgently needed.

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